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# The Heterogeneous Labor Market Effects of Immigration

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## Abstract

In this paper I provide estimates of the impact of immigration on native wage and employment levels (rather than on wage inequality which has been the focus of the literature). I use variation within 2-digit industries across regions using Austrian panel data from 1986 to 2004 for identification. Using an instrumental variable strategy I find large displacement effects in the service sector and large native employment increases in manufacturing due to immigration. This heterogeneous response is explained by large increases in output in manufacturing, due to a high elasticity of product demand, as immigration reduces the cost of production, while on average demand is far less elastic in service industries. Estimated substitution effects, for a given level of output, are large in both industries and in line with US estimates. The structural estimates imply that a 10% increase in the number of immigrants in all industries reduces average native wages by around 0.25% and results in 4% of the native labor force changing industry, primarily from services to manufacturing. Hence, the effect of immigration on worker relocation across industries is far larger than its impact on average native wages.

**Keywords:** immigration, wages, employment, substitution effect, scale effect

**JEL Classification:** J23, J61

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# 1 Introduction

Over the past two decades there have been renewed large and primarily low-skilled immigration flows to most developed countries. On average among OECD countries the fraction of population that is foreign born went from 5.7% in 1988 to around 11% in 2005 and continues to rise. Such large flows are likely to have significant social and economic consequences for the native-born population. One of the most controversial issues in the debate over immigration is whether and to what degree immigrant workers displace native workers and adversely affect their wages. The economics literature has, however, for the most part not addressed these issues directly, but rather focused on the impact immigration has on wage inequality between different groups of workers.<sup>1</sup> To my knowledge this is the first paper to estimate the effect of immigration on the level of employment and wages of native workers and, moreover, I do so separately by industry. Using a panel dataset for Austria I find that immigration increases the demand for native workers in manufacturing, but displaces native workers in services industries. My estimates of the underlying production functions in these two industries suggests that this differential effect is explained by manufacturing firms rapidly expanding output as immigration reduces their cost of production, while the demand for the output of most service industries is relatively inelastic. The structural estimates imply that a 10% increase in the number of immigrants in Austria results in a 0.25% fall in average native wages and a substantial shift in native labor, around 4% of workers, away from service industries to primarily manufacturing.

The approach of this paper adds to the existing literature in a number of important ways. First, by separately identifying both scale and substitution effects arising from an inflow of immigrant labor I am able to identify the impact of immigration on the level of native wages and employment. The substitution effect is that, for a given level of output, an increase in the number of immigrants employed will result in a fall in the demand for native workers (provided the elasticity of substitution between immigrant and native labor is positive). However, an inflow of immigrants will reduce firms' cost of production and so output expands (provided that the elasticity of product demand is negative). As the scale of production increases on account of immigration, for a given relative wage, firms will employ more native workers. The magnitude of this scale effect depends on the elasticity of product demand, the more elastic demand is the larger the scale effect. The previous literature has focused on estimating the differential impact of immigration on natives

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<sup>1</sup>See Card (2009) for a recent take on the state of this literature in the US. Borjas (2009) is an exception, exploring the implications of factor demand theory for the impact of immigration on native wages.

in race/sex groups (Altonji and Card, 1991), different occupations (Friedberg, 2001 and Card, 2003), and education/experience groups (Borjas, 2003 and 2006, Ottaviano and Peri, 2006, and Borjas, Hanson and Grogger, 2008) or on immigrant versus native wages (LaLonde and Topel, 1991, and Cortes, 2008) and, hence, implicitly or explicitly on estimating the elasticity of substitution between these groups of workers.<sup>2</sup> My approach uses administrative panel data on all Austrian employees in the period 1972 to 2004. I identify the impact of immigration over the period 1986 to 2004, where the number of immigrants as a fraction of the labor force went from 5% to 15%. I use the variation in immigration flows across Austria's nine regions within 2-digit industries, pooled over multiple years, to estimate the impact of immigration (1) on native employment in an industry-region, (2) on native wages, and (3) on immigrant wages. With the help of basic production theory I use these estimates to derive the scale and substitution effects arising from immigration, as well as the elasticity of labor supply across industries and regions.<sup>3</sup> Estimating these underlying structural parameters of the production functions in each industry then also allows me to answer policy counterfactuals about the differential impact of, for example, issuing work permits in different industries.

Second, I demonstrate how heterogeneous the impact of immigration is across industries. Whether immigration is a positive or negative shock to the demand for native labor depends on the difference in the magnitude of the scale effect (the elasticity of demand for labor) and the elasticity of substitution between native and immigrant labor. We would expect, in particular, the elasticity of demand, and hence the scale effect, to vary across industries. In manufacturing, where goods are internationally traded, we would expect a high elasticity of demand; whereas in service industries, where output is constrained by local demand, we would expect a low elasticity of demand. This is exactly what I find. In the period 1986 to 2004 the increase in the supply of immigrant labor results in a negative shock to the demand for native labor in service industries, the IV estimates suggest that around 0.6 native workers are displaced by the arrival of one immigrant and there is a modest and not statistically significant fall in average native wages. In contrast, in manufacturing the arrival of one immigrant results on average in the employment of 1.3 additional natives and a small and not statistically significant increase in average wages. The heterogeneous impact of immigration can mainly be explained by a very high elasticity of labor demand in manufacturing and a low elasticity in services, with point estimates of 16.9 and 1.4 respectively. Note that in all industries immigration results in a substantial

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<sup>2</sup>Card (1990) is an exception, estimating the total effect of immigration on native wages and employment.

<sup>3</sup>The elasticity of labor supply plays an important role since it determines to what degree shocks to the demand of native labor result in changes in relative wages or relative employment across industry-regions.

fall in average immigrant wage, with an elasticity of -0.09 in services and -0.22 in manufacturing. A consequence of this heterogeneity is that the wage effects of immigration are likely to be small as compared to the effect on native worker relocation across industries. Heterogeneous effects of immigration across industries imply that native workers will relocate until wages equalize, with the amount of relocation depending on both the degree of heterogeneity across industries and the magnitude of the immigration shock.

Third, the empirical approach in this paper addresses the two major challenges identified in the literature in estimating the impact of immigration on native labor market outcomes. First, immigrants do not choose their locations randomly. Unobserved economic factors that attract immigrants are likely to also affect native worker outcomes. Second, labor and capital are mobile and may respond to immigration by relocating across units of observation. The two main approaches in the literature address these challenges differently. The local labor market approach, first due to Grossman (1982), uses the geographic variation in immigration flows to identify the local impact of immigration. In this approach, following Altonji and Card (1991) and Card (2001), it is possible to instrument for the current distribution of immigration flows by using the historical distribution of immigrants across local labor markets. However, Borjas, Freeman and Katz (1996) and Borjas (2003, 2006) are critical of the local labor market approach arguing that it fails to take account of offsetting capital and native labor mobility across local labor markets, which will tend to attenuate the wage effects of immigration.<sup>4</sup> The second approach uses variation over time at the national level, where native labor supply can be thought of as inelastic, in the relative supply of different types of labor. The disadvantage of this approach is that it maintains the assumption that the composition of immigration flows is exogenous, for example, that changes in the return to education do not affect the educational composition of immigrants. The fact that, using US data, papers using variation across local labor markets have tended to find small effects of immigration and those using the time series methodology have tended to find larger effects suggests that reconciling these approaches is important. My identification strategy combines the strengths of each of these approaches. First, identification is across regions within 2-digit industries, so that I am able to instrument for the distribution of the inflow of immigrants. Second, I explicitly model and estimate the response of natives to immigration and so am able to account for this effect when estimating the elasticities of derived demand.

The rest of the paper is organized as follows. Section 2 outlines a basic model with

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<sup>4</sup>Card and DiNardo (2000), Card (2001, 2005) and Card and Lewis (2007) find that there is near to no offsetting native labor mobility in response to immigration shocks. Borjas (2006) and Cortes (2008) find large, but not perfectly, offsetting displacement effects.

which to understand the impact of immigration. The data and descriptive statistics on immigration to Austria are presented in Section 3. Section 4 describes the instrument, presents estimates of the impact of immigration on native wages and employment, as well as immigrant wages. I then show how these can be used to identify scale and substitution effects arising from immigration and discuss what the implications are for the aggregate impact of immigration to Austria. Section 6 concludes.

## 2 Framework: Substitution and Scale Effects

To understand the labor market impact of immigration the existing literature has focused on estimating the elasticity of substitution between types of labor. However, the elasticity of substitution is only informative about the impact of immigration on relative wages. In general the impact of a shifting the supply of immigrant labor on the wage level of native workers will depend on both the elasticity of substitution and the elasticity of product demand (both a substitution and scale effect). The existing literature has followed Card (2001) by controlling for the scale effect by including year fixed effects; however, to my knowledge, the scale effect has not been explicitly estimated. In this section I provide a model that makes explicit the role of scale and substitution effects. I also explicitly model the location decisions of native workers as a discrete choice model, from which I derive aggregate elasticities of labor supply; and the choices of consumers from which I derive the elasticity of product demand in an industry.

### 2.1 Setup

#### 2.1.1 Firms

Consider an economy with  $S$  competitive industries in  $R$  regions producing final goods  $Y$ , sold at prices  $p$  and produced using a two-level nested-CES aggregation of native labor  $N$ , immigrant labor  $I$  and capital  $K$ .

$$\begin{aligned} Y_{rs} &= F^Y(Q_{rs}, K_{rs}) \\ &= F^Y \square F^Q(N_{rs}, I_{rs}), K_{rs} \end{aligned} \tag{1}$$

with  $\sigma_{in}$  as the elasticity of substitution between native and immigrant labor and  $\sigma_{qk}$  as the elasticity of substitution between labor and capital. Note that as  $\sigma_{in} \rightarrow \infty$  native and immigrant labor become perfect substitutes. I assume constant returns to scale at

the level of each nest. Note that since each nest only contains two inputs I have implicitly assumed that all elasticities of substitution are non-negative (since factor demands are homogenous of degree zero in factor prices). Intuitively, if the wage of immigrant labor falls all else equal more immigrant labor will be employed (the own-price elasticity of factor demand is always negative), and since output is assumed constant less native labor will have to be employed.

### 2.1.2 Consumers

I assume that there are two types of consumers: domestic,  $d$ , and foreign,  $f$ , of mass  $M_d$  and  $M_f$  respectively. They have a utility function represented by

$$U = \left( \sum_s C_s^{\frac{\alpha_s - 1}{\alpha_s}} \right)^{\frac{\alpha_s}{\alpha_s - 1}}$$

where  $C_s$  is consumption of the output of industry  $s$ , which in turn is an index of consumption of goods produced domestically  $C_{s,h}$  or abroad  $C_{s,o}$

$$C_s = \left( b_g C_{s,h}^{\frac{\alpha_f - 1}{\alpha_f}} + (1 - b_g) C_{s,o}^{\frac{\alpha_f - 1}{\alpha_f}} \right)^{\frac{\alpha_f}{\alpha_f - 1}}, \quad g = \{d, f\}$$

where  $b_g$  is a consumer type specific weight for the consumption of foreign or domestic goods, domestic consumption is an aggregate of varieties produced in the regions of the country

$$C_{s,h} = \left( \sum_r C_{rs}^{\frac{\alpha_r - 1}{\alpha_r}} \right)^{\frac{\alpha_r}{\alpha_r - 1}}$$

The goods are substitutes and all the elasticities of substitution are greater than one, i.e.  $\alpha_s > 1$ ,  $\alpha_f > 1$  and  $\alpha_r > 1$ . Moreover, I make the usual assumption that varieties within a country are more substitutable for each other than varieties produced in different countries, which in turn are more substitutable than products from different industries, i.e.  $\alpha_s \leq \alpha_f \leq \alpha_r$ . Note that the parameters  $\alpha_f$ ,  $\alpha_r$  and  $b_g$  could potentially vary by industry.

As was originally shown by Dixit and Stiglitz (1977) the demand for the output of a sectors (in a particular region) is given by

$$Y_{rs} = Y_s \left( \frac{p_{rs}}{P_{s,h}} \right)^{-\alpha_r} \quad (2)$$

where

$$Y_s = (M_d b_d^{\alpha_f} + M_f b_f^{\alpha_f}) C_s \left( \frac{P_{s,h}}{P_s} \right)^{\square \alpha_f}$$

$$P_{s,h} = \sum_r p_{rs}^{\square \alpha_r} \left( \frac{1}{1 - \square \alpha_r} \right)^{\frac{1}{1 - \square \alpha_r}}$$

The elasticity of demand is

$$\frac{d \ln Y_{rs}}{d \ln p_{rs}} = \square \alpha_r + \left( \alpha_r + \frac{d \ln Y_{s,h}}{d \ln P_{s,h}} \right) \frac{d \ln P_{s,h}}{d \ln p_{sr}}$$

which if  $\frac{d \ln P_{s,h}}{d \ln p_{rs}} = 0$  implies that  $\frac{d \ln Y_{rs}}{d \ln p_{rs}} = \square \alpha_r$ .

### 2.1.3 Native Workers

Native workers of a certain type have a choice of industry and region within which to work, where for every worker it is possible to choose any combination of industry  $s \in S$  and region  $r \in R$ . I assume that the utility of worker  $j$  in industry  $s$  and region  $r$  can be expressed as

$$U_{jrs} = \ln a_j + \ln a_{rs} + \ln a_{jrs} + \varepsilon_{js} + \varepsilon_{jr} + \varepsilon_{jrs}$$

In what follows I suppress the  $j$  subscript wherever possible. I further assume that  $\text{var}(\varepsilon_s) = 0$ . Thus

$$U_{rs} = \ln a + \ln a_{rs} + \ln w_{rs} + \varepsilon_r + \varepsilon_{rs} \quad (3)$$

where I assume that  $\varepsilon_r$  and  $\varepsilon_{rs}$  are independent for all industries and regions in workers' choice sets,  $\varepsilon_{rs}$  is independent and identically Gumbel (Extreme Value Type I) distributed with a scale parameter  $\mu^s$ , and  $\varepsilon_s$  is distributed so that  $\max_r U_{rs}$  is Gumbel distributed with a scale parameter  $\mu^r$  (where these scale parameters are inversely related to the variance of the error term).<sup>5</sup> Thus the workers' discrete choice problem takes the form of a two-level nested logit, where workers can be thought of as first choosing a region and then an industry to work in. This formulation of the representative worker's choice problem results in an elasticity of labor supply to an industry-region,  $\phi_n$ , with respect to a change in the wage given by:

$$\frac{d \ln N_{rs}}{d \ln w_{rs}} = \phi_n = \mu^s (1 - P(s|r)) + \mu^r P(s|r) (1 - P(r)) \quad (4)$$

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<sup>5</sup>My formulation of the workers' discrete choice problem follows Ben-Akiva and Lerman (1985).



where  $P(s|r)$  is the probability that a worker in region  $r$  chooses industry  $s$  and  $P(r)$  is the unconditional probability of a worker choosing to work in region  $r$  (see Appendix A.2 for a derivation). The elasticity of labor supply contains two terms: the first pertaining to the response of workers in other industries within the same region, and the second to the response of workers from other regions to a change in the wage. The magnitude of each of these terms (and hence of the elasticity of labor supply) is inversely proportional to the variance of the error terms. Intuitively, a lower variance means that there are proportionally more workers over a given interval who respond to a marginal change in the wage. The nested logit assumption imposes the restriction that all the cross-elasticities within the same nest, i.e. within the same region across different industries, are the same. It does, however, allow the cross-elasticity across nests to differ from that within a nest. The order of the nesting implies that the elasticity of labor supply is higher across industries (with error term  $\varepsilon_r$ ) than across regions (with error term  $\varepsilon_r + \varepsilon_{rs}$ ).

## 2.2 Effects of Immigration

The model delivers a number of important results. The effect of immigration on the wage  $w_n$  and employment  $N$  of native workers in an industry-region is given by

$$\frac{d \ln w_n}{d \ln I} = \frac{s_i (\eta - \sigma_{in})}{\sigma_{in} \eta + \phi_n (s_i \eta + s_n \sigma_{in})} \quad (5)$$

$$\frac{d \ln N}{d \ln I} = \phi_n \frac{d \ln w_n}{d \ln I} \quad (6)$$

where  $\phi_n$  is the elasticity of native labor supply,  $\eta$  is the elasticity of demand for labor and  $s_i$  is the share of immigrant labor in total labor output. See Appendix A.1 for a derivation of the expressions for the labor supply elasticities and the inverse derived demand elasticities and Hicks (1963) and Allen (1938) for more general proofs of these results. The effect of immigration on wages and, since labor supply is upward sloping  $\phi_n > 0$ , on employment of natives is positive when  $\eta > \sigma_{in}$ . The inflow of immigrants is an increase in the labor supply of immigrant labor (for a given wage), reducing the cost of immigrant labor and hence resulting in two countervailing effects: (1) the substitution effect, where for a given level of output firms will substitute immigrant for native labor; and (2) the scale effect, for a given input ratio, the fall in the cost of native labor results in increased demand for native low-skilled labor. Note that the more substitutable immigrant and native labor are, the more likely it is that the wage effect is negative. The expression

for the scale effect is

$$\square \frac{d \ln Q}{d \ln w_q} = \eta = \frac{\sigma_{qk} + \phi_k (s_q + s_k \sigma_{qk})}{\phi_k + s_k + s_q \sigma_{qk}} \quad (7)$$

The scale effect is always positive and is increasing in the elasticity of demand for the final product  $\eta$ , the elasticity of substitution between labor and capital  $\sigma_{qk}$  and elasticity of supply of capital  $\phi_k$ .

The degree to which the demand shock to native labor caused by immigration, whether positive or negative, expresses itself in a change in wages or employment depends on the elasticity of labor supply. The larger the elasticity of labor supply the more the wage effect of immigration is attenuated  $\left( \frac{d}{d\phi_n} \left( \square \frac{d \ln w_n}{d \ln I} \right) < 0 \right)$  and the employment effect is amplified  $\left( \frac{d}{d\phi_n} \left( \square \frac{d \ln N}{d \ln I} \right) > 0 \right)$ .

The effect of immigration on immigrant wages is always negative

$$\frac{d \ln w_i}{d \ln I} = \square \frac{\phi_n + s_n \eta + s_i \sigma_{in}}{\sigma_{in} \eta + \phi_n (s_i \eta + s_n \sigma_{in})} < 0$$

and the effect on total labor output is always positive

$$\frac{d \ln Q}{d \ln I} = \frac{s_i \eta (\sigma_{in} + \phi_n)}{\sigma_{in} \eta + \phi_n (s_i \eta + s_n \sigma_{in})} > 0 \quad (8)$$

## 3 Data

### 3.1 Dataset

The analysis in this paper uses a dataset containing social security records for all individuals employed in Austria between the years 1972 and 2005, with the exception that I observe tenured public sector employees only starting in 1988 (or in some cases 1995). The observations are specific to a match between an employee and employer in a certain year (so continuous employment relations are truncated into separate observations ending on December 31 and starting on January 1 of a year). Observations contain information on income and days worked, as well as the type of employment. Also recorded for individuals are their gender, nationality, date of birth, and location of residence. For the employer I observe their 4-digit industrial classification and location. I also observe spells of unemployment, maternity (or paternity) leave and, only for women, live births. There is some top-coding of income, which in no year affects more than 9% of employees; income is not observed for tenured public sector employees. There is also some bottom-coding

of incomes, which in no year affects more than 8% of employees. Until 1997 only an individual's latest nationality and location of residence is observed. Education records are obtained from data provided by the Austrian Employment Service (AMS) and only exist for individuals who are unemployed at some point during their career. Apprenticeships during the period 1972 to 2005 are observed directly in the data. I impute education for everyone else.<sup>6</sup> I distinguish between low skilled (those with at most compulsory schooling), medium skilled (those having completed apprenticeships or vocational training) and high skilled (completed *Matura* or tertiary education). Notice that these definitions are very different than the ones employed in the US. Since I have longitudinal information on workers I can construct actual experience and actual tenure variables. Work experience prior to 1972 is imputed using the information on education and average employment rates for men and women in prior years. Observed income is nominal (in euros) and per day worked.

The unit of observation for most of the empirical work in this paper is a 2-digit industry in one of Austria's nine regions. I use the NACE economic activities classification scheme of the European Union. The exception is construction (itself a 2-digit industry), in which I use the 3-digit classification. I also combine agriculture with forestry and fishing to create a single industry. For around 16% of observations I have no information on the industry they work in (this is a problem only for the self-employed) and consequently I exclude them from the analysis. I exclude the public sector and non-for-profit industries from most of the analysis, reducing the sample size by 19%. I also exclude those industries that do not employ at least 20 foreigners in the period 1972 to 1979, accounting for 8% of native observations. Finally, since identification is (in large part) across regions I only include industries that on average employ at least 20 workers per year in at least six of the nine regions. This restriction reduces the sample size by 13%.

## 3.2 Background

### 3.2.1 Immigration

During the 1970s until 1988 the percentage of employees in Austria who are foreign nationals is stable at around 4.5%. Then from 1988 onwards the number of foreign

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<sup>6</sup>For 35% of native and 29% of foreign observations education needs to be imputed. I impute education for individuals using a multinomial logit. The explanatory variables are gender, cohort, as well as income, 2-digit industry, region and type of employment at various stages of a worker's career, and, where available, a proxy for years of schooling. The within sample fraction of correctly imputed education levels for natives is 59%, and 53% for foreign workers. For natives the fraction that has to be imputed is 40%, 23% and 56% for low, medium and high skilled education groups respectively. The corresponding within sample fraction correctly imputed is 68%, 44% and 63% respectively.

workers more than doubles in four years. From around 4.9% of those employed (180,000 individuals) in 1988 to around 10.5% (421,000 individuals) in 1992; after which it continues rising to around 15% (see Figure 1).<sup>7</sup> Up until 1989 most foreigners in Austria were from Yugoslavia, with a sizeable fraction from Turkey and an increasing number from developed countries. Following 1989 there was an increase in foreigners from all countries, but in particular Eastern Europe (see Figure 2).

Legally employed immigrants initially only have a temporary work permit (*Beschaeftigungsbewilligung*) valid for at least one year which ties them to a specific employer, or are seasonal workers who are allowed to be continuously employed for at most nine months and for at most 12 out of every 14 months. After one year of employment immigrants can apply for an *Arbeitserlaubnis* which allows them unrestricted access to employment within a region (*Bundesland*) of Austria. Finally, in general after five years of employment, or for second generation immigrants at completion of compulsory schooling, immigrants receive a permanent work permit (*Befreiungsschein*) that allows them unrestricted access to the labor market, as well as allowing their family to join them and work in Austria. Major changes in legislation occurred in 1997 (reducing immigration quotas, especially for family members) and in 2005. Quotas are decided upon by the Ministry for Industry and Labor (*BMWA*) and implemented by the Austrian Employment Service (*AMS*). Since 1994 nationals EU-15 countries have unrestricted access to the Austrian labor market. In 2000, for example, 146,774 new work permits were issued, of which 78,008 were temporary (of which 38,589 were for seasonal work), 10,349 received an *Arbeitserlaubnis* and 44,369 were permanent work permits.<sup>8</sup>

The fraction foreign in total employment increases rapidly in all industries over this period, 1986 to 2004, from 5.8% to 12.9% in manufacturing and 4.8% to 16.1% in services. Table 1 shows full-time equivalent employment of natives and immigrants in each of the two-digit industries used in the analysis for the years 1987 and 2004. The share of the wage bill accruing to foreigners is somewhat lower since immigrants make between 15% to 20% less than natives on average. The fraction of low-skilled workers is much higher among foreigners than natives in Austria, as is the fraction employed in blue collar jobs, and the fraction female is lower. See Table 2 for more details.

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<sup>7</sup>Note that individual's nationality and not country of birth is recorded. Also nationality is available in the data only since 1997 on account of the way the Social Security Administration makes the data available. So it is not possible to directly observe an individual's nationality prior to 1997. This is a problem since throughout the 1980s and 1990s annually around 2-3% of foreigners living in Austria became Austrian citizens, according to data from the Austrian Forum for Migration Studies. Commonly foreigners can typically acquire the Austrian citizenship after having lived in Austria for 10 years, or at least 5 years if married to an Austrian citizen.

<sup>8</sup>Nowotny (2007)

### 3.2.2 Labor Market

From 1972 onwards the Austrian labor market was characterized by a steady growth in employment. Male labor market participation rates declined in the 1970s from 85% and have since stabilized at around 80%. Meanwhile, female labor market participation steadily increased, from under 50% in the early 1970s to over 65% now. Austria has had low unemployment rates over the last 40 years; using ILO definitions unemployment was under 2% in the 1970s, 3-4% in the 1980s and somewhat over 4% since then. The unemployment rate of foreign nationals in Austria is higher than that of Austrians and increased from 5.5% in 1986 to 7.4% in 1992 and then continued trending upwards to 10% in 2004.<sup>9</sup> Labor market participation rates at the time of the 2001 census were 87% for men and 65% for women, somewhat higher than for Austrians. The participation rate varies substantially by country of origin and among men is lowest for those from EU and EFTA countries (78%) and among women among those from Turkey and Africa (around 56%). The informal economy accounts for less than 10% of GDP in Austria and somewhat more of employment. Immigrants probably have a somewhat higher propensity to be employed illegally than Austrians, with estimates varying from 10% to 20% of total employment.<sup>10</sup> The fraction of immigrants among the self-employed (who I exclude from the analysis) is 5.4% in 1988 and increases to 9.0% in 1992 and continues to increase slowly to nearly 11%, somewhat slower than the overall share of the number of immigrants.<sup>11</sup>

The OECD Employment Outlook (2004) ranks Austria in the middle of OECD countries in terms of employment protection, with substantially higher protection than in the US, Canada or the UK, and less protection than Germany, France, Spain or Sweden. Notice periods for continuous employment relationships, i.e. not short or fixed term contracts, for white collar workers (*Angestellte*) start at 6 weeks and increase with uninterrupted tenure at a firm. For blue collar workers notice periods are agreed at an industry level as part of the collective bargaining process. They vary from 1 day in construction, to up to 5 months for high skilled blue collar workers (*Facharbeiter*) in parts of manufacturing.<sup>12</sup> Severance pay, starting at two months salary, for all workers is only available after 3 years of uninterrupted tenure at a firm and not available if the separation is due

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<sup>9</sup>Nowotny (2007) using the Austrian, rather than ILO, definition of unemployment. Under Austrian definitions the unemployment rate is always higher, currently around 2 percentage points, than under ILO definitions.

<sup>10</sup>Jandl (2007) and IOM (2005). In the early 1990s there was a form of amnesty for a lot of illegally employed foreign nationals, there has been no such amnesty since (Nowotny, 2007).

<sup>11</sup>Austrian Forum for Migration Research

<sup>12</sup>The definition of a white collar worker is defined by law (*Angestelltengesetz*) and includes all salespersons and office workers (including secretaries and receptionists). Everyone else is a blue collar worker unless otherwise agreed, either by collective bargaining or at a firm or on an individual basis.

to a voluntary quit by the worker.<sup>13</sup>

Austria has a complex collective bargaining system covering 95% of employees in 2002. Currently around 450 separate wage agreements (*Kollektivverträge*) are reached by employer and employees representatives at the national level every year. These agreements typically specify minimum wages and minimum wage increases for employees by industry, occupation, skill level, and seniority. Agreements can be binding or merely recommended best-practice, and provide the framework within which actual wages are set. Detailed information on collective bargained minimum wages is only available for part of the economy, broadly corresponding to the manufacturing sector and for firms with 10 or more employees. In the 1980s actual wages were on average around 30% above the minimum mandated by collective bargaining, and only around 10% of employees were actually paid that minimum. Since then there has been a narrowing of this gap, and currently it is around 20%. In a number of industries there are also agreed minimum wage growth rates of actual wages; these are typically somewhat smaller than the increases in the minimum wage and set above the rate of inflation, but below the rate of nominal growth.<sup>14</sup>

## 4 Wage and Employment Effects of Immigration

The identification strategies in this paper rely on inter-regional variation in the inflow (over time) of immigrants into an industry. Below I discuss in detail the instrument I will use to deal with the potential endogeneity of the distribution of immigrants. I also check for the existence of pre-existing trends and conduct a falsification exercise. I then proceed to provide OLS and linear IV estimates of the impact of immigration on native worker displacement and wages. Finally, I use these results to estimate the structural parameters of the model outlined in the Section 2, which I then use to infer the effects of various counterfactuals.

### 4.1 Instrument

The inflow of immigrants may be correlated with unobserved shocks to the demand for labor in a region. If immigrants are more likely to go to regions that are experiencing positive shocks to the demand for native and immigrant labor, then the OLS estimate of the effect of immigration on native employment and wages is upward biased. It is equally possible that immigrant inflows are affected by the availability of jobs in an industry. A

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<sup>13</sup>Severance pay legislation was revised substantially for all employment relationships beginning after January 1, 2003. I describe the earlier system.

<sup>14</sup>Pollan (2001, 2005)

plausible way in which the supply-side may matter is that declining industries may make a special effort to attract immigrant labor. For example, as described, many immigrants require a work permit to legally work in Austria; one way that declining industries may respond is by exerting political pressure that more work permits be issued for immigrants working in their industry. In that instance there is a negative correlation between the inflow of immigrants and shocks to the wages and employment of native labor and the OLS estimates would be downward biased.<sup>15</sup> The possibility of biased OLS estimates makes it important to instrument for the inflow of immigrants to an industry-region.

I instrument for the distribution of the inflow of immigrants using the pattern of foreign employment in the 1970s. The underlying idea is that one of the primary determinants of an immigrants' destination choice is a social network that helps them settle in a foreign country, as well as helping them find a job.<sup>16</sup> I use a long baseline period, 1972 to 1979, so as to minimize the effect of short-term employment fluctuations and measurement error, which given that the number of foreigners in some industry-region cells is small could lead to a weak first stage. The social networks justification for the use of this instrument suggests that I distinguish between foreigners by nationality. Sample size considerations lead me to put foreigners in Austria into six categories: former Yugoslavia, Turkey, Eastern Europe, developed countries, Germany and Switzerland (since nationals of those two countries are likely to speak German), and immigrants from the rest of the world.

Formally, the instruments for the inflow of immigrants to a certain 2-digit industry  $s$  and region  $r$  at time  $t$  are given by

$$\Delta I_{rst}(IV) = \sum_{nationality} \frac{nationality_{rs,72-79}}{nationality_{s,72-79}} * \Delta nationality_{st} \quad (9)$$

The first stage is highly significant in all industries, apart from Food and Accommodation, and correlation coefficient between the actual and instrumented inflow of immigrant labor to an industry-region averaged over the period 1986 to 2004 is 0.5 (see Table 3).

## 4.2 Pre-Existing Trends and Falsification

For the instrument to be valid it has to be uncorrelated with other unobserved factors that may affect native (and immigrant) labor market outcomes during the period 1986 to 2004. All the main specifications in this paper are in growth rates and control for

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<sup>15</sup>This is what Friedberg (2001) finds when examining the distribution of Russian arrivals in Israel after the end of the Cold War.

<sup>16</sup>See Card (2001), Card and Lewis (2007) and Cortes (2008) for how this instrument works for the US. Munshi (2003) provides a detailed analysis of such networks for Mexicans in the US.

2-digit industry by year effects, so much of the identification comes from the within 2-digit industry across regions variation in immigration flows. Hence, the biggest threat to the validity of the instrument is that there are long-term region specific trends in the growth rate of native employment or native wages that are correlated with the fraction of immigrants in that region (within each industry). Fortunately, the data lends itself to subjecting the instrument to a falsification exercise. During the period 1980 to 1985 there is near to no net immigration to Austria (see Figure 1) or any particular 1-digit industry. Hence, it is possible to test whether during this period the historical distribution of immigrants (and hence the instrument) is correlated with native labor market outcomes in this pre-period. The results suggests that the instrument is correlated with region-specific trends in native employment in manufacturing, see Table 4. This correlation is negative in all 1-digit industries, foreigners seem to be disproportionately employed in regions where an industry is in decline. This means that the instrumental variable estimates of the impact of immigration on native wages and employment may be downward biased on account of long-term demand trends. To deal with the potential bias arising from long-term region-specific trends I include region by 1-digit industry fixed effects in all subsequent specifications.

### 4.3 Reduced-Form Estimates: Immigration, Wages and Employment

The model of the previous section assumes that there is an exogenous shock to the supply of immigrants. Instrumenting for the inflow of immigrants is meant to ensure exogeneity, however, it remains to be shown that immigration can be thought of as a shock to the supply of immigrant labor. If that is true then the wages of immigrants should fall in response to an inflow of new immigrants, which in practice does not have to be true. For example, LaLonde and Topel, 1991, find that new immigrants affect cohorts of previous immigrants differentially and so the average effect of immigration on immigrant wages could be positive, in which case the model of the previous section is clearly misspecified. I regress the (instrumented) inflow of immigrants ( $\Delta \ln I$ ) into an industry-region ( $rs$ ) in a given year ( $t$ ) on the change in wages of foreign nationals ( $\Delta \ln w_{i,rst}$ )

$$\Delta \ln w_{i,rst} = \beta_1 \Delta \ln I_{rst} + \delta_{st} + \delta_r + \varepsilon_{1,rst} \quad (10)$$

The specification includes 2-digit industry by year fixed effects ( $\delta_{st}$ ) and region fixed effects ( $\delta_r$ ). My main specifications are regressions of log changes on log changes since these



best correspond to the theory in the previous section. In all specifications observations are weighted by employment in each industry-region cell. Identification of the effect of immigration is from the within 2-digit industry variation in immigration flows across regions, pooled over years and conditional on region-specific long-term trends. No other covariates are included. Reassuringly in all 1-digit industries both the OLS and IV estimates are negative (see Table 5). The IV estimates suggest an elasticity of immigrant wages to immigration flows of -0.22 in manufacturing and -0.09 in the service industry.

I proceed to estimate the impact of immigration on native employment growth ( $\Delta \ln N$ ) and native wage growth ( $\Delta \ln w_n$ )

$$\Delta \ln N_{rst} = \beta_2 \Delta \ln I_{rst} + \delta_{st} + \delta_r + \varepsilon_{2,rst} \quad (11)$$

$$\Delta \ln w_{n,rst} = \beta_3 \Delta \ln I_{rst} + \delta_{st} + \delta_r + \varepsilon_{3,rst} \quad (12)$$

I present the results, pooled by 1-digit industry, in Tables 6 and 7. In the data (OLS estimates) immigration is positively correlated with native employment growth, suggesting that there are common reasons why immigrants and natives move to a certain industry-region. However, the correlation with wages is not uniformly positive, suggesting that the data is generated by a combination of shocks to both demand and supply (hence wage and employment changes are uncorrelated). To disentangle the causal effect of immigration from this data I instrument immigration flows with the instrument described above, see equation (9).

The IV estimates reveal that the effect of immigration is highly heterogeneous across industries. Notably, the estimates suggest that immigration is a positive demand shock for native labor in manufacturing, the point estimates of the elasticity of native employment with respect to immigration at the industry-region level is 0.15. The wage effects of immigration in manufacturing are near zero. However, immigration can be thought of as a negative demand shock for native labor in the service industries (defined as trade services, food and accommodation and business services), with an elasticity of -0.069 for employment and -0.023 for wages (though the wage effect is not statistically significant). Since on average the fraction of immigrants in total employment is around 11% in manufacturing and 12% in services, the estimated elasticities translate into large changes in native employment. An exogenous inflow of one immigrant results in the employment of nearly 1.4 additional native worker in manufacturing. In contrast, in services an additional immigrant displaces 0.58 native workers.

Since the magnitude of the effect of immigration on native wages is small we can conclude that the elasticity of labor supply across industry-regions is high. The point

estimates suggest that on average the elasticity of labor supply is substantially larger in manufacturing (around 19) than in services (around 3). The magnitude of the elasticity of labor supply will depend on the level of aggregation at which the impact of immigration is measured (in my case a 2-digit industry in a region), the length of time over which the impact is measured (in my case a single year) and institutional features, such as centralized wage-bargaining, that constrains wage-setting behavior. An important consequence of the high elasticity of labor supply is that the sign of the demand shock (positive or negative) to native labor due to immigration is more easily discernible in the data on employment than in wages. Further, if the effect of immigration and the elasticity of labor supply are both heterogeneous it is difficult to interpret estimates at an aggregate level. That may, for example, explain why the effects of immigration on wages and employment in business services, which is a highly heterogeneous industry, go in the opposite direction.

The differences between the OLS and IV estimates provides evidence on the factors that determine the location decisions of immigrants. Notice that the bias in the OLS estimates is not uniform across industries. In services the OLS estimates are consistently more positive than IV estimates, which means that demand shocks are an important determinant of immigrant location decisions  $E[I_{rst}\varepsilon_{rst}] > 0$ . In manufacturing the OLS estimates are barely biased,  $E[I_{rst}\varepsilon_{rst}] \simeq 0$ , and demand and supply shocks seem to offset each other when it comes to determining immigrant location decisions. Similarly, the OLS estimates of the impact of immigration on immigrant wages are less negative than the IV estimates, which suggests that immigrant location decisions respond to demand shocks and/or that the type of immigrant affected by the instrument has a more detrimental effect on the wage of existing immigrants than those of the average immigrant. To check whether long-run region specific trends in demand are important I also run the same regressions without region-specific fixed effects. The point estimates are not substantially affected by the exclusion of region fixed effects.

Throughout this paper I am thinking of changes in (instrumented) immigration flows as shocks to the supply of immigrant labor, and hence as shocks to the demand for other types of (native) labor. This approach differs somewhat from the dominant approaches in the literature, as exemplified by Card (2001) and Borjas (2003), which view immigration as shocks to factor proportions, as measured by education or experience. The main reason for doing so is practical, my data on worker education and foreign worker experience is limited, and so it does not seem sensible to rely on an approach that emphasizes changes in factor proportions. Recall that the education categories I use do not correspond to those used in the US since Austria's education system is very different. Moreover, there are a number of reasons, including measurement error, why workers across education

groups are more similar than we might wish. Nevertheless, it is surprising that the effect of immigration on the wages and employment of low-skilled natives is very similar to that of higher-skilled natives (see Table 8). It seems as though in Austria educational attainment, at least the way I am able to measure it, is not a very salient feature for understanding wage differentials (see Blau and Kahn, 1996, and Leuven, Oosterbeek and van Ophem, 2004 for further discussion of this issue for countries other than the US). For this reason I will not differentiate between natives by education in the remainder of this paper, though all the models in this paper are easily extended to allow for differential effects by education. Similarly, the instrumental variable estimates do not show a statistically significant differential impact of immigration on male versus female native workers. There is some evidence though that blue collar workers do better than white collar workers, which is surprising since immigrants are predominantly blue collar. What is striking is that throughout the OLS estimates suggest that immigration is positively correlated with the relative outcomes of the factors which immigrants disproportionately bring to the labor market, that is low skilled, male and blue collar as compared to high skilled, female and white collar. This suggests that the distribution of immigrant flows responds to differential factor returns rather than vice-versa.

An advantage of the instrumental variable approach (over a more structural approach for example) is that it helps deal with measurement problems. For example, there are large numbers of illegally employed, and hence unobserved, immigrant and native workers resulting in both attenuation bias (if illegal and legal immigration flows are uncorrelated) and more complicated biases (if they are correlated) in the OLS estimates. Similarly, the educational attainment and experience of immigrants is not likely to be constant within an industry-year causing biased OLS estimates. But for the instrumental variable estimates it is only necessary that these compositional effects are uncorrelated with the initial distribution of immigrants.

There are however a number of other confounding factors that bias the estimates of the employment and wage effects of immigration. First, I am assuming that immigration causes native workers to change employers solely on account of changes in the wage. However, there may be non-pecuniary reasons why natives may or may not wish to work with immigrants. If, for example, natives have a distaste for working with immigrants then the estimate of the impact of immigration on native employment is biased downward. This is because, as well as changing the demand for native labor, immigration also reduces the supply of native labor for a given wage.

Further, immigration to an industry-region may, for example, significantly increase the demand for the output of that industry-region, which would result in an upward bias of the

estimates (specifically, the estimated elasticity of product demand will be upward biased, since I would be confusing shifts in demand with the elasticity of demand). However, even if workers spend all of their income in the same region (recall that the returns to capital can accrue to investors from all over the world) only a very small fraction would be ultimately be spent on the output of the industry they are actually employed in, so this bias is likely to be small.

Also, immigration may cause changes in both the "quality" of native workers, as well as the quantity. If immigrants were better substitutes for low than high ability (as measured by units of human capital) natives then I would be overestimating the wage and underestimating the employment effects of immigration. This is a concern that can potentially be addressed using the panel aspect of the data. Finally, the IV estimates only measure the impact of those immigrants whose location decision is affected by the presence of previous cohorts of immigrants, which may be different from the impact of an average immigrant.

## 4.4 Structural Estimates and Implications

### 4.4.1 Model Identification

The share of the total wage bill that goes to native and immigrant labor,  $s_n$  and  $s_i$  respectively, is observed directly in the data. On average over the period 1986 to 2004 the share of immigrant is labor 9.7% in manufacturing and 10.3% in services. It is somewhat less than the average number of immigrants as a fraction of the workforce (which is 11.2% in manufacturing and 12.2% in services) since on average wages of immigrants are 16.1% and 18.5% lower than that of natives in manufacturing and services respectively. Further, I restrict all the elasticities of native labor supply to be the same across industry-regions. In the absence of information on the capital stock employed in each industry-region in each year I do not decompose the scale effect (the elasticity of labor demand) into its various components. That leaves three unknown parameters  $\sigma_{in}$  and  $\phi_n$ . There are three linearly independent estimating equations I estimated above,  $\frac{d \ln w_n}{d \ln I}$ ,  $\frac{d \ln N}{d \ln I}$  and  $\frac{d \ln w_i}{d \ln I}$ , thus the system is identified.

The inclusion of industry by region fixed effects means that the estimates of the previous section are (at least theoretically) unbiased. Hence, the reduced form estimates can be used to derive the structural parameters of the derived demand elasticities. I estimate the structural parameters as follows. The labor supply elasticity is simply the effect of immigration on native employment divide by the effect on native wages, see regressions

(11) and (12).

$$\phi_n = \frac{d \ln N}{d \ln I} / \frac{d \ln w_n}{d \ln I} = \beta_2 / \beta_3$$

In the same way the elasticity of substitution between native and immigrant labor  $\sigma_{in}$  can be derived

$$\sigma_{in} = \frac{d \ln (I/N)}{d \ln (w_n/w_i)} = \frac{1 - \beta_2}{\beta_3 - \beta_1}$$

where the coefficients are from regressions (11), (12) and (10)). Finally, I use the expression for  $\frac{d \ln N}{d \ln I}$  to find the elasticity of labor demand:

$$\eta = \frac{\sigma_{in} \left( s_i + s_n \frac{d \ln N}{d \ln I} \right)}{s_i \left( 1 - \frac{d \ln N}{d \ln I} \right) - \sigma_{in} \frac{d \ln w_n}{d \ln I}}$$

Note that given the assumed nested structure of the production function I am able to derive the elasticity of labor demand independent of any assumptions about the elasticity of the supply of capital. Finally, equation (8) can be used to find the elasticity of product demand for a given supply elasticity of capital

$$= \frac{\phi_k (\eta - s_k \sigma_{qk}) + s_q \sigma_{qk} \eta}{\phi_k s_q + \sigma_{qk} - s_k \eta}$$

The strategy described relies on the assumption that the elasticity of labor supply is identical across industry-regions and over time. Maintaining that assumption and using the average  $P(s|r)$  and  $P(r)$  as observed in the data, it is possible to identify the scale parameters of the native workers' discrete choice problem ( $\mu^s$  and  $\mu^r$ ). To identify these I use the expression for the ratio of new hires to an industry-region that originate in the same region  $H(s'|r)$  and from other regions  $H(r')$  (using equations (19) and (20) in Appendix A)

$$\frac{H(s'|r)}{H(r')} = \frac{\mu^s (1 - P(s|r))}{\mu^r (1 - P(r))} - (1 - P(s|r)) \quad (13)$$

#### 4.4.2 Results and Interpretation

The parameter estimates for manufacturing, the service sector are summarized in Table 9. Notice that it is not possible to identify the elasticity of labor supply with any accuracy. However, I cannot reject the hypothesis that labor is perfectly elastically supplied to an industry-region. The point estimate of the elasticity of substitution between immigrants and natives is 3.7 in manufacturing and 15.9 in the service sector. These estimates are in line with other studies: Cortes (2008) finds an elasticity of substitution between native and immigrant labor of around 4 and Manacorda, Manning and Wadsworth (2007) of

around 6 using UK data.<sup>17</sup>

I find an elasticity of labor demand at the industry-region level of 16.9 in manufacturing and 1.4 in services, and thus in manufacturing the scale effect is larger than the substitution effect and vice versa in services.<sup>18</sup> I have not found any estimates directly comparable to these, indeed this paper is the first paper to estimate scale effects arising from an inflow of immigrants. However, if we are willing to assume that capital is perfectly elastically supplied and combined with the labor aggregate in a Cobb-Douglas production function, then a back of the envelope calculation suggests that the elasticity of product demand in manufacturing at the 2-digit industry by region level is 34. In comparison Broda and Weinstein (2006) find that for US trade averaged across products the elasticity of substitution between goods, which in this context can be thought of as comparable to my elasticity of product demand, is 7. Broda, Greenfield and Weinstein (2006) provide estimates separately by country and the mean elasticity of substitution estimate for 3-digit manufacturing industries in Austria is around 15 (the distribution is right skewed, when excluding the top and bottom 5% of the estimates the mean is around 5).

In neither industry can we reject the hypothesis that labor is perfectly elastically supplied, though the point estimate is higher in manufacturing. As discussed in the previous section, on account of the high elasticity of labor supply across industry-regions the effect of immigration on the demand for native labor does not show up in changes in wages at the industry-region level, but rather in changes in employment. In services immigrants displace native workers and in manufacturing they increase the demand for native labor.

Note that the average wage (including natives and immigrants) in any industry-region will fall as a result of immigration, the estimates suggest an elasticity of average wages of -0.03 in services and -0.014 in manufacturing with respect to an inflow of immigrants. The reason that native wages are nevertheless able to increase of course crucially depends

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<sup>17</sup>Note that within education groups, and hence using different variation from the one used in this paper, Card (2009) suggests that this elasticity of substitution is around 20 in the US; while, Borjas, Hanson and Grogger (2008) conclude that perfect substitutability between immigrant and native labor can not be rejected.

<sup>18</sup>It is interesting to note that, in this context, I can evaluate the validity of Marshall's third law of derived demand: "The demand for anything is likely to be less elastic, the less important is the part played by the cost of that thing in the total cost of some other thing, in the production of which it is employed." (Bronfennbrenner, 1961, p. 8, quoting A. C. Pigou). As Hicks (1932) and Allen (1938) pointed out this is only true if the elasticity of demand for the output being produced is larger than the elasticity of substitution, i.e. if the ability of consumers to substitute between goods is greater than producers ability to substitute between inputs. I find Marshall's third law to be true in manufacturing, but false in services (at least as pertains to the effects of an inflow of immigrants).

on native and immigrant labor being imperfect substitutes.(see Borjas, 2009, and Card, 2009, for extensive discussions of this issue). Interestingly, within the context of the model outlined in Section 2, where demand is modeled as being derived from demand for differentiated goods and labor is mobile across industries, even in the long-run with perfectly mobile capital and labor the impact of immigration on average wages will not be equal to zero. The reason is that demand for goods in such a model will always be downward-sloping and, hence, as immigrants expand the production of domestic goods their price will have to fall.

Up to now I have discussed the impact of immigration into a single industry-region. That is not the same as the effect of an aggregate increase in the number of immigrants in all of Austria. In aggregate, at the level of an immigration flow to all industry-regions in Austria, immigration will affect native wages. There are two major issues in going from the industry-region level estimates to an aggregate effect, these are: (1) immigrants are also consumers and so immigration results in a shift (for a given price) in the demand for goods and services produced in Austria, and (2) the elasticity of demand for Austrian products is likely to be lower than for those produced in an individual industry-region.

To help me illustrate these issues take an immigration shock that is of the same magnitude in all industry-regions (which is not that far from what actually happened in Austria). Then, using the equations in Section 2.1.2 and the fact that prices are homogeneous of degree one, the difference in the impact of immigration on output in an industry at the aggregate national level  $\frac{d \ln Y_{sh}}{d \ln I_{sh}}$  and regional level  $\frac{d \ln Y_{sr}}{d \ln I_{sr}}$  is

$$\frac{d \ln Y_{sh}}{d \ln I_{sh}} \square \frac{d \ln Y_{sr}}{d \ln I_{sr}} = \frac{M_d b_d^{\alpha_f}}{M_d b_d^{\alpha_f} + M_f b_f^{\alpha_f}} \square (\alpha_r \square \alpha_f) \left( \square \frac{d \ln p_{sr}}{d \ln I_{sr}} \right) \quad (14)$$

where  $\frac{M_d b_d^{\alpha_f}}{M_d b_d^{\alpha_f} + M_f b_f^{\alpha_f}}$  is the domestic share of consumption of domestic products.<sup>19</sup> The first term of expression (14) reflects the increase in aggregate demand for domestic goods as a consequence of immigration and the second term reflects potentially different elasticities of product demand at the region and country level (typically we assume that  $\alpha_r > \alpha_f$ ).<sup>20</sup> If we can assume that capital is perfectly elastically supplied, as well as that

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<sup>19</sup>Exports accounted for around 24% of GDP in 1976 and 58% of GDP in 2006. They started growing particularly quickly after 1995 when Austria joined the EU. Data on the relevant variable, what fraction of domestic output is domestically consumed, is surprisingly difficult to obtain. For the type of services included in my sample (primarily food and accommodation and retail and wholesale trade) presumably close to all of output is domestically consumed. In manufacturing, in contrast, most output is likely to be exported.

<sup>20</sup>A related issue is that the estimated elasticity of labor supply is across industry-regions. However, if the inflow of immigrants into all regions is of equal magnitude then workers will not change jobs across

$(\alpha_r \square \alpha_f) \left( \square \frac{d \ln p_{sr}}{d \ln I_{sr}} \right)$  is small enough to be negligible, then from (7) and (14) it follows that the elasticity of labor demand with respect to an aggregate immigration shock is

$$\eta^A = \eta + s_q \frac{M_d b_d^{\alpha_f}}{M_d b_d^{\alpha_f} + M_f b_f^{\alpha_f}}$$

We are now in a position to use the estimates of the structural parameters to draw inferences about any number of possible immigration scenarios. I will focus on the effects of a 10% increase in the number of immigrants in every industry-region of Austria. To simplify matters I assume that manufacturing and services are the only two industries, that labor is perfectly elastically supplied to each industry (an assumption that is not rejected by the data even at an annual frequency), so that wages equalize across industries, and that labor is supplied inelastically in aggregate. The aggregate shift in the demand for native labor is simply the weighted sum of the shift in demand in each industry on account of the immigrant inflow. Given that labor is inelastically supplied to the labor market this shift in demand is also equal to the change in average native wages.<sup>21</sup> The estimates suggest that a 10% increase in immigrant labor across all industry-regions would decrease average native wages by 0.25%. Given the change in wages and the assumptions that the aggregate labor supply elasticity is equal to zero and that wages equalize across industries we can infer how many native workers move jobs given the estimated demand shocks to the two industries. The implication is that around 4% of native workers move from the service sector to manufacturing, reducing native employment in services by around 6% and increasing it in manufacturing by around 14%.<sup>22</sup> Further, using the total differential of

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region within an industry, but only across industries within a region. The within region across industry elasticity is

$$\frac{d \ln N_s}{d \ln w_s} = \mu^s (1 \square P(s|r))$$

as compared with equation (4).

<sup>21</sup>The aggregate change in demand ( $\Delta D$ ) is equal to the average change in native wages given an inelastic supply of labor ( $\Delta \bar{w}_n$ ) and is given by

$$\Delta D = \Delta \bar{w}_n = \frac{s_{i,j} \square \eta_j^A \square \sigma_{in,j}}{\sigma_{in} \eta_j^A}$$

where industry  $j$  is either manufacturing ( $M$ ) or services ( $S$ ).

<sup>22</sup>The total differential of wages in an industry is given by

$$d \ln w_n = \frac{\partial \ln w_n}{\partial \ln N} d \ln N + \frac{\partial \ln w_n}{\partial \ln I} d \ln I$$

where  $\frac{\partial \ln w_n}{\partial \ln N} = \square \left( s_n \frac{1}{\sigma_{in}} + s_i \frac{1}{\eta} \right)$  and  $\frac{\partial \ln w_n}{\partial \ln I} = s_i \left( \frac{1}{\sigma_{in}} \square \frac{1}{\eta} \right)$ . Hence, if there are only two industries, there is wage equalization across industries and in percentage terms the immigrant inflows are the same



immigrant wages, I calculate that average immigrant wages would fall by 2.2% and .97% in manufacturing and services respectively. Hence, wages averaged across both natives and immigrants would fall by 0.36% (which qualitatively is what we would expect given the differentiated goods model of Section 2 combined with the fact that immigrants increase the supply of domestic goods by more than they increase the demand for such goods). One of the main results of the paper of course is that the industry which immigrants determines whether they increase or decrease the demand for native labor. If all immigrants joined manufacturing industries, then average native wages in the economy would increase by 0.20%; while if they exclusively joined the service sector then average native wages would fall by 0.43%. Clearly, from the perspective of the welfare of natives it matters hugely where immigrants work.

## 5 Conclusions

There is a large literature on the impact of immigration on inequality between different types of native labor. This paper contributes to the immigration literature by estimating the impact on wage and employment levels. The effect of immigration on inequality depends on the elasticity of substitution, which is defined for a given level of output, between types of labor. The impact on wage levels also depends on the degree to which output expands as immigration reduces the cost of production. The magnitude of this scale effect depends on the elasticity of product demand, with the effect of immigration on the demand for native labor depending on the difference in the magnitude of scale and substitution effects. An important insight of the paper is that the scale effect will vary considerably by industry, since the elasticity of product demand will vary, and so immigration is likely to have a highly heterogeneous effect depending on what industry immigrants join. The more the scale of output can expand, and the lower the elasticity of substitution, the more immigration will benefit native labor. This insight has implications for policy, for example, for the decision to what industries to issue work permits. A further consequence of the heterogeneous impact of immigration on the demand for native labor is that even if average wage effects are small immigration is likely to induce large amounts of relocation between industries, from those industries where immigrants displace

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in both industries then the flow of native labor between industries is

$$dN = \frac{\left( \frac{\partial \ln w_{n,2}}{\partial \ln I_2} \square \frac{\partial \ln w_{n,1}}{\partial \ln I_1} \right)}{\left( \frac{1}{N_1} \frac{\partial \ln w_{n,1}}{\partial \ln N_1} \square \frac{1}{N_2} \frac{\partial \ln w_{n,2}}{\partial \ln N_2} \right)} d \ln I$$

native workers to those where they increase the demand for natives. It is worth noting that a neglect of the role of scale effects and heterogeneous responses in thinking about demand shocks is not unique to the immigration literature. For example, the literature on the impact of trade on workers has also focused primarily on estimating elasticities of substitution and typically ignores scale effects (an exception being Grossman and Rossi-Hansberg, 2008), and hence the issue whether trade increases or decreases the level of demand for different workers in a country.

Given the evidence on the heterogeneity of scale effects across industries it would be important to identify what observable industry or worker characteristics can explain these differences. The tradeability of final output is an obvious example and there are likely to be numerous others. Similarly, the magnitude of the elasticity of substitution will depend on industry characteristics and, as the literature using US data has found, on the characteristics of native and immigrants workers. In this paper I abstract from these issues and measure some kind of average response, but further work is likely to uncover other reasons for which responses to immigration are heterogeneous across types of workers.

The paper also contributes to the debate on how to best empirically identify the impact of immigration. The approach the paper takes is to use an instrumental variable strategy to deal with the endogeneity of immigrant location decisions. This is the approach the local labor markets literature takes and is open to the criticism that natives will decide to move across units of observation in response to immigration, thereby attenuating the measured impact of immigration. I deal with this concern by explicitly modeling the response of natives to immigration and accounting for this effect when estimating scale and substitution effects. My methodology thereby addresses the drawbacks of both the local labor markets and the time series approach, which does not allow for the instrumenting of the distribution of immigration flows, to identifying the impact of immigration. Moreover, even if both methods yielded unbiased estimates they exploit different variations in the data (across regions or at the national level over time) and may yield different estimates accordingly. In this paper I show how one can, at least in part, bridge the gap between estimates of the impact of immigration derived from time-series and cross-section variation.

The paper's focus is on native workers and, with the help of the instrumental variables strategy, I abstract from how immigrants behave. A complete analysis of the issue would have to consider how immigrants are absorbed into an economy. In particular, how in the long-term they are integrated into the national labor market. This issue goes beyond the scope of this paper, but may be very important in thinking about the long-term effects

of immigration.

## Appendix A

In this section I derive the factor demand elasticities and elasticities of labor supply for the model in Section 4. I suppress industry and region subscripts.

### A.1 Elasticities of derived demand

Firms maximize profits subject to equations (1) and (2). Taking the derivative of the first-order conditions with respect to a change in the number of immigrants:

$$\frac{d \ln w_i}{d \ln I} = \frac{d \ln Q}{d \ln I} \left( \frac{1}{\sigma_{in}} \square \frac{1}{\eta} \right) \square \frac{1}{\sigma_{in}} \quad (15)$$

$$\frac{d \ln w_n}{d \ln I} \square \frac{d \ln w_i}{d \ln I} = \frac{1}{\sigma_{in}} \left( 1 \square \frac{d \ln N}{d \ln w_n} \frac{d \ln w_n}{d \ln I} \right) \quad (16)$$

Eliminating  $\frac{d \ln w_i}{d \ln I}$  using (15) and (16)

$$\frac{d \ln Q}{d \ln I} = \frac{d \ln w_n}{d \ln I} \frac{\eta (\sigma_{in} + \phi_n)}{(\eta \square \sigma_{in})} \quad (17)$$

Then I differentiate the production function and use the fact that with constant returns to scale  $s_i = \frac{w_i I}{w_q Q} = \frac{w_i}{w_q} \frac{I}{Q} = \frac{F_I I}{Q}$  and  $s_n = \frac{w_n N}{w_q Q} = \frac{F_N N}{w_q Q}$

$$\begin{aligned} \frac{dQ}{dI} &= F_I + F_N \frac{dN}{dw_n} \frac{dw_n}{dI} \\ \frac{d \ln Q}{d \ln I} &= s_i + s_n \phi_n \frac{d \ln w_n}{d \ln I} \end{aligned} \quad (18)$$

I eliminate  $\frac{d \ln Q}{d \ln I}$  using (17) and (18) to find the expression for  $\frac{d \ln w_n}{d \ln I}$ , see equation (5). Then substitute into (17) to find the expression for  $\frac{d \ln Q}{d \ln I}$  (8). Finally, substituting this expression into (15) to obtain  $\frac{d \ln w_i}{d \ln I}$  as a function of the exogenous parameters.

## A.2 Native worker labor supply

A worker's chooses an industry and a region in which to work following (3). Hence, the marginal probability that a worker chooses region  $r$  is given by the probability that

$$P(r) = \Pr \left[ \varepsilon_r + \max_s (\ln \alpha_{rs} + \ln w_{rs} + \varepsilon_{rs}) \geq \varepsilon_{r'} + \max_s (\ln \alpha_{r's} + \ln w_{r's} + \varepsilon_{r's}), \quad \forall r' \in R, r' \neq r \right]$$

Since  $\varepsilon_{rs}$  is Gumbel distributed with parameter  $\mu^s$  the term  $\max_s (\ln \alpha_{rs} + \ln w_{rs} + \varepsilon_{rs})$  is also Gumbel distributed and can be written as  $\tilde{\alpha}_r + \tilde{\varepsilon}_r$  where

$$\begin{aligned} J_r &= \sum_s (\alpha_{rs} w_{rs})^{\mu^s} \Big)^{1/\mu^s} \\ \tilde{\varepsilon}_r &= \max_s (\ln \alpha_{rs} + \ln w_{rs} + \varepsilon_{rs}) \square \tilde{\alpha}_r \end{aligned}$$

and  $\tilde{\varepsilon}_r$  is Gumbel distributed with scale parameter  $\mu^s$ . The combined disturbance  $\varepsilon_r + \tilde{\varepsilon}_r$  is, as assumed, independent and identically Gumbel distributed with scale parameter  $\mu^r$  for all  $r \in R$ , therefore

$$P(r) = \frac{e^{\mu^r \ln J_r}}{\sum_{r' \in R} e^{\mu^r \ln J_{r'}}} = \frac{J_r^{\mu^r}}{\sum_{r' \in R} J_{r'}^{\mu^r}}$$

The conditional choice probability of choosing industry  $s$  having decided on region  $r$  is

$$P(s|r) = \Pr [\ln \alpha_{rs} + \ln w_{rs} + \varepsilon_{rs} \geq \ln \alpha_{rs'} + \ln w_{rs'} + \varepsilon_{rs'}, \quad \forall s' \in S, s' \neq s | r \text{ chosen}]$$

The components attributable to the industry cancel, so

$$P(s|r) = \frac{e^{\mu^s \ln \alpha_{rs} w_{rs}}}{\sum_{s'} e^{\mu^s \ln \alpha_{rs'} w_{rs'}}} = \frac{(\alpha_{rs} w_{rs})^{\mu^s}}{\sum_{s'} (\alpha_{rs'} w_{rs'})^{\mu^s}}$$

and the joint probability is

$$P(r, s) = P(s|r) P(r) = \frac{(\alpha_{rs} w_{rs})^{\mu^s}}{\sum_{s'} (\alpha_{rs'} w_{rs'})^{\mu^s}} \frac{J_r^{\mu^r}}{\sum_{r'} J_{r'}^{\mu^r}}$$

Assuming  $\bar{N}$  homogeneous workers the labor supply to a given industry and region is  $N_{rs} = \bar{N} P_r(r, s)$ . The elasticity of the labor supply to an industry-region with respect to a change in the wage is found by taking the derivative with respect to  $w_{rs}$  and is given by (4). Further, the cross-elasticity of labor supply with respect to a change in the wage

of an industry in a different region is

$$\begin{aligned}\frac{d \ln P(r', s)}{d \ln w_{rs}} &= \frac{d \ln P(r')}{d \ln J_r} \frac{d \ln J_r}{d \ln w_{rs}} \\ &= \square \mu^r P(r) P(s|r) = \square \mu^r P(s, r)\end{aligned}\quad (19)$$

The cross-elasticity of labor supply with respect to a change in the wage of an industry in the same region is

$$\begin{aligned}\frac{d \ln P(r, s')}{d \ln w_{rs}} &= \frac{d \ln P(s'|r)}{d \ln w_{rs}} + \frac{d \ln P(r)}{d \ln J_r} \frac{d \ln J_r}{d \ln w_{rs}} \\ &= \square \mu^s P(s|r) + \mu^r P(s|r) (1 \square P(r))\end{aligned}\quad (20)$$

Combining (19) and (20) yields the expression for the ratio of within region to outside of region hires (13).

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Figure 1: Fraction of Foreigners in Total Employment

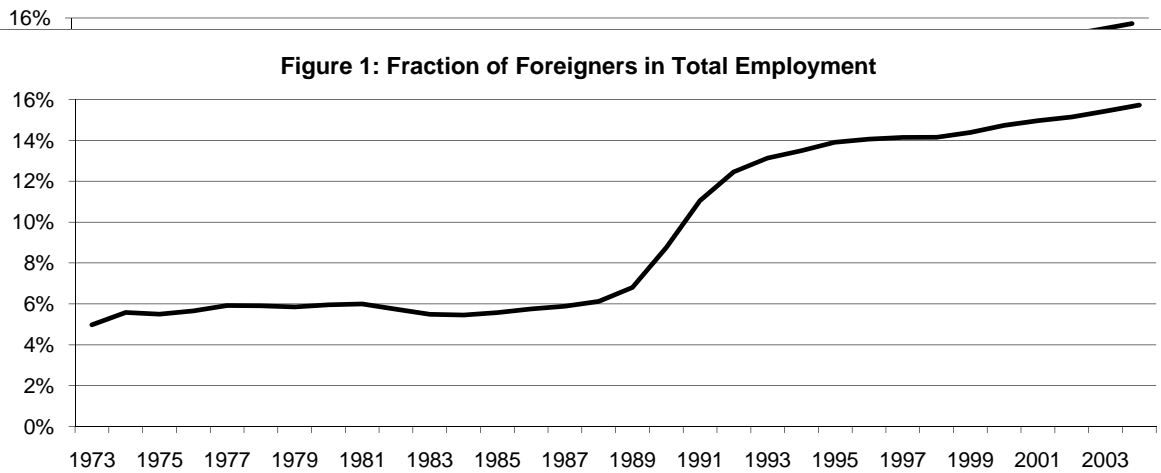


Figure 2: Foreigners by Origin (in millions of days worked)

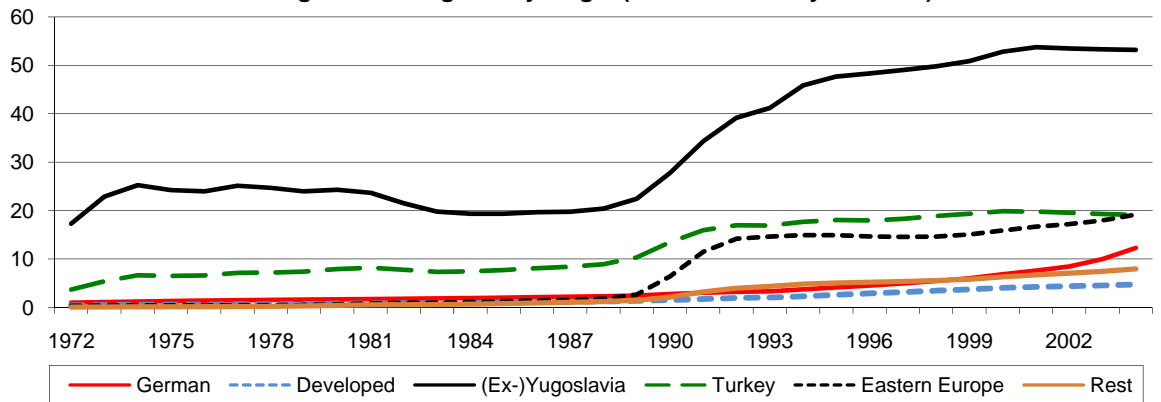
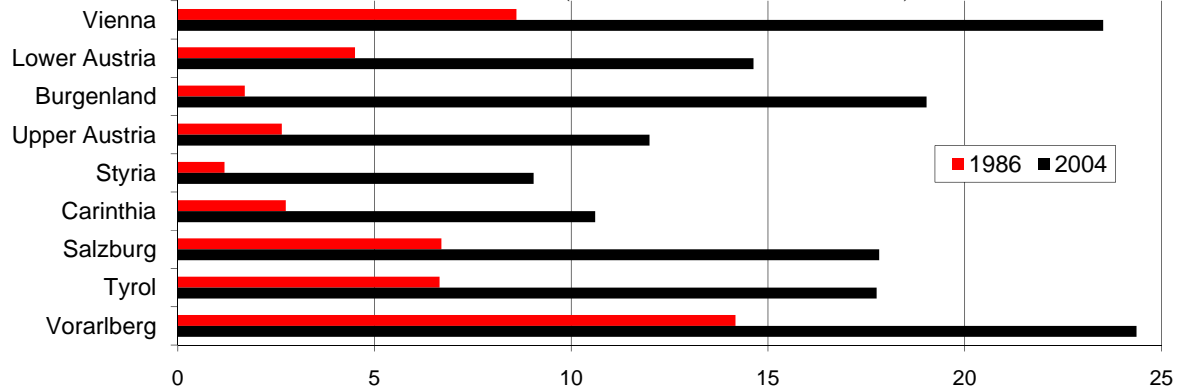
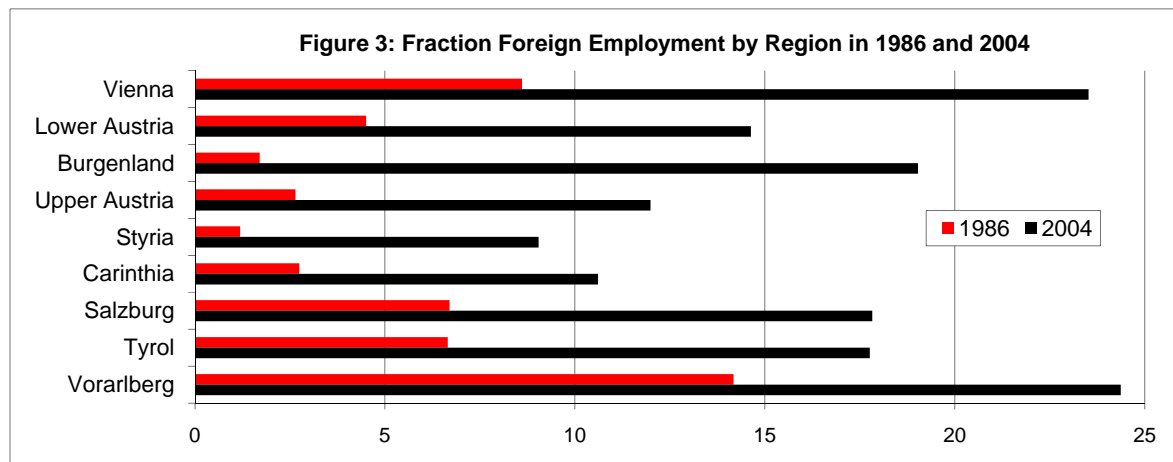
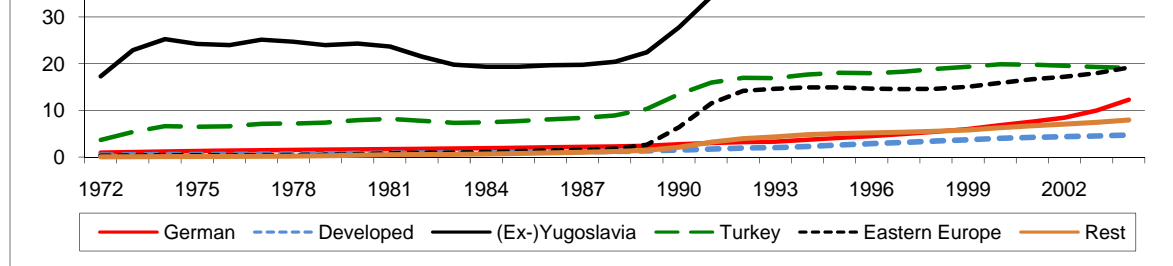


Figure 3: Fraction Foreign Employment by Region in 1986 and 2004







**Figure 3:** Fraction foreign employment (by region in 1986 and 2004)

**Table 1:** Full-time Equivalent Employment by 2-Digit Industry

	Native Employment		Foreign Employment	
	1987	2004	1987	2004
<b>Agriculture and forestry</b>	24456	21108	2146	8834
<b>Manufacturing</b>				
Wearing apparel	33014	8000	2551	1798
Leather and leather products	10503	3932	682	1200
Chemicals and chemical products	34437	28627	1330	2916
Rubber and plastic products	21508	20175	2092	4721
Other non-metallic mineral products	29319	24556	1358	3439
Fabricated metal products	56860	58032	4663	10827
Machinery and equipment	58058	58012	2346	5781
Electrical machinery and apparatus	18430	16916	1270	1556
<b>Construction</b>				
General construction	119916	101027	10241	26574
Installation	37091	45974	1083	6702
Building completion	24158	29195	1041	7837
<b>Services</b>				
Sale and maintenance of motor vehicles	50567	61860	1602	6874
Wholesale trade	171413	177323	6265	19750
Retail trade	175484	228229	4848	26324
Hotels	41237	43441	5742	19659
Restaurants and bars	52107	77585	5952	32279
Land transport	56814	77602	2999	17726
Other business activities	76840	201835	5225	44793
Other service activities	24416	30141	1479	5186

**Table 2:** Summary Statistics

	Manufacturing		Services		All Industries	
	1986	2004	1986	2004	1986	2004
Fraction Foreign (in )	5.8	12.9	4.8	16.1	5.3	16.2
Share Foreign (in %)	5.2	11.0	4.0	13.7	4.6	13.7
Relative Wage Foreign (in %)	-11.2	-17.7	-19.7	-19.4	-15.1	-20.1
Fraction Low Skilled (in %)						
Foreign	78.4	66.8	75.6	67.8	77.3	67.6
Native	36.2	23.4	30.0	27.9	32.3	26.8
Fraction Blue Collar (in %)						
Foreign	84.1	77.1	78.4	71.5	82.0	75.0
Native	62.8	53.9	46.2	42.2	54.3	47.2
Fraction Female (in %)						
Foreign	28.5	25.1	43.8	46.5	31.2	36.4
Native	35.4	26.7	50.1	54.1	40.2	44.5
Average Age (in years)						
Foreign	35.6	36.8	33.8	33.5	35.1	34.6
Native	32.9	35.8	31.6	34.6	32.3	35.0

**Table 3:** Actual Immigration on Predicted Immigration (by 1-digit industry)

Dependent variable: Log Change in Immigrant Employment						
	Manufacturing	All Services	Construction	Retail Trade	Food and Acc.	Bus. Services
Instrument	0.328*** (0.057)	0.282*** (0.082)	0.275*** (0.078)	0.319*** (0.079)	0.237 (0.157)	0.377*** (0.065)
Partial R-squared	0.25	0.14	0.20	0.24	0.18	0.28
No. Observations	1296	1290	486	648	324	324
						3234

\* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%. Unit of analysis is a 2-digit industry in a region in a year. Observations are weighted by the number of employees in each cell. All regressions include 2-digit industry by year fixed effects and region fixed effects for each industry. Standard errors are clustered on 2-digit industry by region cells and are robust to heteroscedasticity.

**Table 4:** Correlation of Instrument with Changes in Native Wages and Employment in Pre-period (1981-85), by 1-digit industry

		Dependent variable: Change in Native Employment / Log Change in Native Wages / Log Change in Immigrant Wages						
		Manufacturing	All Services	Construction	Retail Trade	Food and Acc.	Bus. Services	All Industries
		Foreign Wages						
Instrument		-0.049*** (0.012)	-0.001 (0.004)	-0.007 (0.009)	-0.04 (0.038)	-0.01 (0.006)	0.006 (0.008)	-0.001 (0.004)
Partial R-squared		0.000	0.000	0.010	0.000	0.000	0.000	0.000
No. Observations		360	360	135	180	90	90	900
		Native Employment						
Instrument		-0.036*** (0.012)	-0.04 (0.032)	-0.024 (0.021)	-0.042*** (0.011)	-0.045 (0.028)	-0.017 (0.02)	-0.036*** (0.015)
Partial R-squared		0.040	0.010	0.010	0.120	0.030	0.010	0.010
No. Observations		360	360	135	180	90	90	900
		Native Wages						
Instrument		-0.001 (0.003)	0.007 (0.005)	-0.016 (0.009)	0.001 (0.005)	-0.003 (0.006)	-0.001 (0.003)	0.001*** (0.003)
Partial R-squared		0.000	0.010	0.030	0.000	0.000	0.000	0.000
No. Observations		360	360	135	180	90	90	900

\* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%. Unit of analysis is a 2-digit industry in a region in a year. Observations are weighted by the number of employees in each cell and estimates are robust to heteroscedasticity. I cluster on 2-digit industry by region and all regressions include 2-digit industry by year fixed effects.

**Table 5:** Impact of Immigration on Changes in Immigrant Wages (by 1-digit industry)

Dependent variable: Log Change in Immigrant Wages		All Services		Manufacturing		Construction		All Industries	
		OLS	IV	OLS	IV	OLS	IV	OLS	IV
$\Delta$ Log Foreign Emp.		-0.065** (0.032)	-0.09*** (0.027)	-0.075*** (0.012)	-0.218*** (0.076)	-0.043*** (0.014)	-0.046* (0.027)	-0.067*** (0.015)	-0.107*** (0.025)
Partial R-squared		0.05		0.09		0.08		0.07	
No. Observations		1296	1296	1296	1290	486	486	3240	3234
		Retail Trade		Food and Acc.		Bus. Services			
$\Delta$ Log Foreign Emp.		OLS	IV	OLS	IV	OLS	IV		
		-0.026 (0.035)	-0.089*** (0.032)	-0.009 (0.014)	-0.172 (0.127)	-0.158*** (0.056)	-0.089 (0.059)		
Partial R-squared		0.03		0.07		0.12			
No. Observations		648	648	324	324	324	324		

\* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%. Unit of analysis is a 2-digit industry in a region in a year. Observations are weighted by the number of employees in each cell. All regressions include 2-digit industry by year fixed effects and region fixed effects for each industry. Standard errors are clustered on 2-digit industry by region cells and are robust to heteroscedasticity.

**Table 6:** Impact of Immigration on Changes in Native Employment (by 1-digit industry)

Dependent variable: Log Change in Native Employment		All Services		Manufacturing		Construction		All Industries	
		OLS	IV	OLS	IV	OLS	IV	OLS	IV
$\Delta$ Log Foreign Emp.		0.125*** (0.042)	-0.069* (0.041)	0.158*** (0.022)	0.152*** (0.074)	0.043*** (0.011)	0.037 (0.027)	0.121*** (0.022)	0.019 (0.024)
Partial R-squared		0.2		0.22		0.33		0.2	
No. Observations		1296	1296	1296	1290	486	486	3240	3234
		Retail Trade		Food and Acc.		Bus. Services			
		OLS	IV	OLS	IV	OLS	IV		
$\Delta$ Log Foreign Emp.		0.132* (0.073)	-0.098*** (0.048)	0.03 (0.02)	-0.391 (0.275)	0.146*** (0.044)	0.072 (0.059)		
Partial R-squared		0.22		0.09		0.2			
No. Observations		648	648	324	324	324	324		

\* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%. Unit of analysis is a 2-digit industry in a region in a year. Observations are weighted by the number of employees in each cell. All regressions include 2-digit industry by year fixed effects and region fixed effects for each industry. Standard errors are clustered on 2-digit industry by region cells and are robust to heteroscedasticity.

**Table 7:** Impact of Immigration on Changes in Native Wages (by 1-digit industry)

Dependent variable: Log Change in Native Wages		All Services		Manufacturing		Construction		All Industries	
		OLS	IV	OLS	IV	OLS	IV	OLS	IV
$\Delta$ Log Foreign Emp.		0.003 (0.014)	-0.023 (0.018)	0.008 (0.006)	0.008 (0.013)	0.008* (0.005)	-0.002 (0.008)	0.006 (0.007)	-0.011 (0.009)
Partial R-squared		0.04		0.01		0.07		0.04	
No. Observations		1296	1296	1296	1290	486	486	3240	3234
		Retail Trade		Food and Acc.		Bus. Services			
$\Delta$ Log Foreign Emp.		0.02 (0.019)	-0.005 (0.014)	0.014 (0.01)	-0.144 (0.092)	-0.035* (0.019)	-0.04 (0.049)		
Partial R-squared		0.08		0.02		0.05			
No. Observations		648	648	324	324	324	324		

\* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%. Unit of analysis is a 2-digit industry in a region in a year. Observations are weighted by the number of employees in each cell. All regressions include 2-digit industry by year fixed effects and region fixed effects for each industry. Standard errors are clustered on 2-digit industry by region cells and are robust to heteroscedasticity.

**Table 8:** Differential Impact of Immigration on Changes in Native Employment

Dependent variable:	Difference High to Low Education Workers			
	All Services		Manufacturing	
	OLS	IV	OLS	IV
$\Delta$ Log Foreign Emp.	-0.042*** (0.015)	0.007 (0.03)	-0.057*** (0.011)	-0.042 (0.031)
Partial R-squared	0.61	0.6	0.34	0.34
No. Observations	1296	1296	1296	1290
Dependent Variable:	Difference Female to Male Workers			
	All Services		Manufacturing	
	OLS	IV	OLS	IV
$\Delta$ Log Foreign Emp.	-0.073*** (0.027)	0.055 (0.04)	0.004 (0.019)	0.036 (0.05)
Partial R-squared	0.42	0.37	0.24	0.23
No. Observations	1296	1296	1296	1290
Dependent Variable:	Difference White Collar to Blue Collar Workers			
	All Services		Manufacturing	
	OLS	IV	OLS	IV
$\Delta$ Log Foreign Emp.	-0.103*** (0.023)	0.032 (0.043)	-0.062*** (0.012)	-0.078** (0.033)
Partial R-squared	0.5	0.46	0.34	0.34
No. Observations	1296	1296	1296	1290

\* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%. Unit of analysis is a 2-digit industry in a region in a year. Observations are weighted by the number of employees in each cell. All regressions include 2-digit industry by year fixed effects and region fixed effects for each industry. Standard errors are clustered on 2-digit industry by region cells and are robust to heteroscedasticity.



**Table 9:** Structural Parameter Estimates

	All Services	Manufacturing
Elasticity of Substitution ( $\sigma_{in}$ )	15.9** (7.2)	3.7*** (1.2)
Elasticity of Labor Demand ( $\eta$ )	1.4 (1.2)	16.9* (10.2)
Elasticity of Labor Supply ( $\phi_n$ )	3.0 (2.8)	18.8 (30.3)
Hire (s r) / Hire (r')	2.9	2.1
Immigrant labor share ( $s_i$ )	0.10	0.10
Native labor share ( $s_n$ )	0.90	0.90

\* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%.  
Standard errors were calculated using the delta method.